CLAIMS

What is claimed is:

1. A method of preventing interfacial reactions between a semiconductor surface and a metal comprising the steps of:

preparing a passivated semiconductor surface using a valence-mending agent; and

depositing a layer of metal on the valence-mended semiconductor surface.

2. The method of claim 1, wherein the metal is selected from the group used in semiconductor devices.

3. The method of claim 1, wherein the valence-mended semiconductor surface is one atomic layer thick.

4. The method of claim 1, wherein the semiconductor surface is selected from the group consisting of silicon, germanium, silicon-germanium and silicon-carbide.

5. The method of claim 1, wherein the method is temperature sensitive.

6. The method of claim 5, wherein temperatures below 700 degrees Centigrade prevent the interfacial reactions.

7. The method of claim 1, wherein the passivating agent is selected from the group consisting of a Group V, VI, or VII cogener, or hydrogen.

8. A method of preventing interfacial reactions between a semiconductor surface and a dielectric comprising the steps of:

preparing a passivated semiconductor surface using a valence-mending agent; and

depositing a dielectric or dielectric precursor on the valence-mended semiconductor surface.

9. The method of claim 8, wherein the dielectric or dielectric precursor is a high dielectric constant material with a dielectric constant larger than 4.

10. The method of claim 8, wherein the valence-mended semiconductor surface is one atomic layer thick.

11. The method of claim 8, wherein depositing a dielectric on the valence-mended semiconductor surface provides for a thin dielectric layer.

12. The method of claim 8, wherein the passivating agent is selected from a group consisting of Group V, VI or VII cogener, or hydrogen.

13. The method of claim 8, wherein the semiconductor surface is selected from the group consisting of silicon, germanium, silicon-germanium and silicon-carbide

14. A method of suppressing chemical reactions on a semiconductor surface comprising the steps of:

preparing a passivated semiconductor surface using a valence-mending agent; and

heating the valence-mended semiconductor surface and suppressing chemical reactions from occurring on the surface.

15. The method of claim 14, wherein the semiconductor surface is selected from the group consisting of silicon, germanium, silicon-germanium and silicon-carbide.

16. The method of claim 14, wherein the valence-mended semiconductor surface is one atomic layer thick.

17. The method of claim 14, wherein the valence-mended semiconductor surface has no dangling bonds.

18. The method of claim 14, wherein adsorbates weakly bond to the valence-mended semiconductor surface prior to heating.

19. The method of claim 18, wherein adsorbates desorb after heating the valence-mended semiconductor surface.

20. The method of claim 14, wherein heating uses temperatures of at least about 100 to 600 degrees Centigrade.

21. A method of cleaning a semiconductor surface exposed to air comprising the steps of:

preparing a passivated semiconductor surface using a valence-mending agent; and

heating the valence-mended semiconductor surface, thereby cleaning the surface of molecular species found in air.

22. The method of claim 21, wherein the semiconductor surface is selected from the group consisting of silicon, germanium, silicon-germanium and silicon-carbide.

23. The method of claim 21, wherein the valence-mended semiconductor surface is one atomic layer thick.

24. The method of claim 21, wherein the valence-mended semiconductor surface has no dangling bonds.

25. The method of claim 21, wherein physical adsorbates weakly bond to the valence-mended semiconductor surface.

26. The method of claim 25, wherein the adsorbates desorb after heating the valence-mended semiconductor surface.

27. The method of claim 21, wherein heating uses temperatures of at least about 100 to 600 degrees Centigrade.

28. A method of preventing a semiconductor surface from oxidation comprising the steps of:

preparing a passivated semiconductor surface using a valence-mending agent; and

heating the valence-mended semiconductor surface in an oxygen-containing ambient, thereby preventing oxidation.

29. The method of claim 28, wherein the semiconductor surface is selected from the group consisting of silicon, germanium, silicon-germanium and silicon-carbide.

30. The method of claim 28, wherein the valence-mended semiconductor surface is one atomic layer thick.

31. The method of claim 28, wherein heating uses temperatures of at least about 100 to 600 degrees Centigrade.

32. A semiconductor surface free of interfacial reactions between the surface and a second molecular species comprising:

a semiconductor surface with one atomic layer of valence-mending atoms, wherein valence mending occurs after introducing the semiconductor surface to a passivating agent.

33. The semiconductor surface of claim 32, wherein the second molecular species is selected from the group consisting of metals, dielectrics, oxygen, water vapor, carbon, hydrogen, carbon dioxide, carbon monoxide, and combinations thereof.

34. The semiconductor surface of claim 32, wherein the semiconductor surface is selected from the group consisting of silicon, germanium, silicon-germanium and silicon-carbide.

35. The semiconductor surface of claim 32, wherein the passivating agent is selected from the group consisting of Group V, VI, or VII cogener, or hydrogen.

36. The semiconductor surface of claim 32, wherein interfacial reactions are selected from the group consisting of oxidation, chemical adsorption, solicidation, and combinations, thereof.

37. A kit for preventing interfacial reactions from occurring on a semiconductor surface comprising:

a passivating agent; and

an instructional manual.

38. The kit of claim 37, wherein the instructional manual is selected from the group consisting of a computer disk, CD-ROM, electronic media, brochure, and combinations thereof.

39. The kit of claim 37, wherein the passivating agent is selected from the group consistency of Group V, VI, or VII cogener, or hydrogen.